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# Notes on Forestry and Wood-use



Purdue University  
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West Lafayette, Indiana 47907

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## PROPAGATION TECHNIQUES FOR BLACK WALNUT

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High prices (Lott and Park, 1972) paid for black walnut timber have produced a great interest in the establishment of walnut plantations. If future plantations are to produce up to their full potential, the rapid production of genetically improved seed is of primary importance. The establishment of grafted seed orchards is one of the best methods to obtain genetic improvement rapidly (Zobel and McElwee, 1964, and Barber and Dorman, 1964). Grafted or clonal seed orchards are established by grafting branches or scion collected from superior selections found in the forest environment onto ordinary seedlings in a centrally located plantation. Techniques are required to insure that selected individuals can be propagated to establish seed orchards. The cutting pressure is so great on high quality black walnut that the gene pool is being drastically reduced. Superior selections must be preserved by grafting before they are cut, or their genetic make-up will be irretrievably lost.

This publication resulted from a study that compared five different propagation techniques in an effort to determine which methods were suitable to establish black walnut seed orchards.

### Materials and Methods

Scionwood can best be obtained from superior trees by shooting branches down with a rifle. A .22 caliber rifle with hollow-point ammunition is excellent for this purpose. Normally, 3-inch diameter branches are shot down and scions are collected, from the ends of these larger branches. One or two branches will provide sufficient scions for grafting.

For maximum graft survival, large scionwood, 3/8-inch to 5/8-inch diameter, is recommended. However, scionwood of 1/4-inch diameter can be used successfully. Best collected during January through March, scions should be packed in moist sphagnum moss in polyethylene bags as they are collected in the field and then placed in cold storage at a temperature of 34 to 36 degrees F. If the temperature is too warm, the buds will break dormancy before the grafting season thus rendering the scions useless. Scions can be stored until June without harmful effects. The amount of moisture present during storage is very important since the scions are liable to be damaged by fungal development under wet conditions. The scions should be checked

occasionally during prolonged storage periods to avoid excessive moisture. When the scions are carried to the field at the time of grafting, they should be kept cool and moist.

The best scionwood is obtained from the basal portion of the 1-year wood, or from the 2-year-old wood. The terminal portion of the 1-year wood is too succulent and pithy to make good scionwood. Whenever possible, the grafting cuts should be made on the 2-year-old scionwood with buds present from the year-old wood. After the graft is completed, the terminal portion of the scion should be cut off so that two or three good buds remain. If additional buds are left on the scion, a number of them may begin growth, and a bushy growth habit will develop.

Generally the rootstocks should range from 2 to 7 years in age at the time of grafting although the size makes little difference in cleft grafting. However, rootstocks must be at least 1 inch in diameter for successful bark inlay grafting. If smaller rootstocks are used, the cambiums of the stock and scion will not be in contact because of the curvature of the rootstock. Sever the tops of the rootstock 10 to 14 days before grafting to allow ample time for the stocks to terminate bleeding, which can cause graft failure because of excess sap flow. At the time of grafting, the stocks need to be cut off again to expose live cambial tissue upon which the graft union can be made.

Two grafting techniques, the bark inlay and the cleft graft, have proven successful. In both methods, you should wrap the union with a rubber strip ( $3/8'' \times 8''$ ) to hold the

scion securely in place. The rubber strip must be tight enough to insure that sufficient pressure is maintained to keep the cambiums of the stock and scion in contact. However, it should not be tight enough to restrict growth. The rubber strips will deteriorate with time and need to be replaced until the union has securely callused.

Then paint the completed graft with paraffin, taking care to cover the entire scion and all exposed cut surfaces to prevent drying. Avoid using excessively hot paraffin, which will damage the buds or kill the cambial cells of the scion.

Adventitious buds developing below the graft union should be removed every few days to force scion growth. If these shoots are not removed, they will weaken and eventually kill the graft.

The graft union is weak and so the graft should be staked during the first 2 years to reduce the strain placed on the union by the wind.

Both cleft grafts and bark inlay grafts are best made in late April or May.

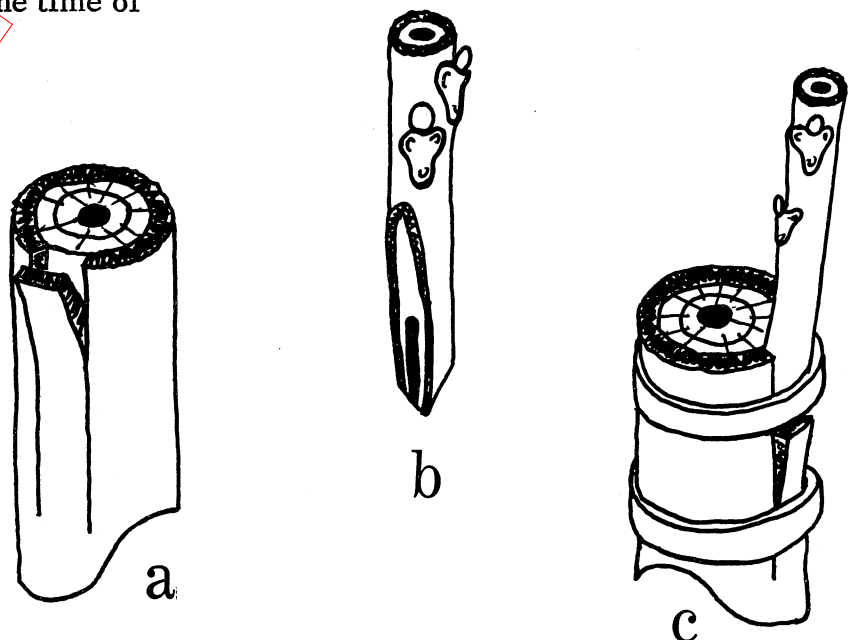


Figure 1. Bark inlay graft.  
A, stock; B, prepared scion;  
C, completed graft before  
waxing.

### Bark Inlay Graft

Following are the steps in performing the bark inlay technique after the active growth of the rootstock has started:

1. Preparation of the stock (Figure 1-A) --
  - a. Sever the top of the rootstock just above the grafting point 10 to 14 days before grafting.
  - b. Cut a disk from the top of the stock to expose live cambium at time of grafting.
  - c. Vertical, parallel cuts 1 to 2 inches long should be made through the bark of the stock. The distance between these cuts should equal the width of the scion.

2. Preparation of the scion (Figure 1-B) --
  - a. Make a sloping cut 1 to 2 inches long on one side.
  - b. Make a second cut 1/2-inch long on the opposite side.

3. Completion of the graft (Figure 1-C) --
  - a. Peel the bark from the stock and insert the scion in the slot.
  - b. Remove the top two-thirds of the bark flap.
  - c. Tie the scion in place with a rubber strip.
  - d. Wax both the grafted stock and the scion.
  - e. Make occasional checks to replace the rubber strips as they deteriorate; or aluminum foil may be wrapped securely around the stock to prevent deterioration.
  - f. Adventitious shoots should be removed from the stock as they develop.

### Cleft Graft

Following are the steps in performing the cleft graft before the active growth of the rootstock has started:

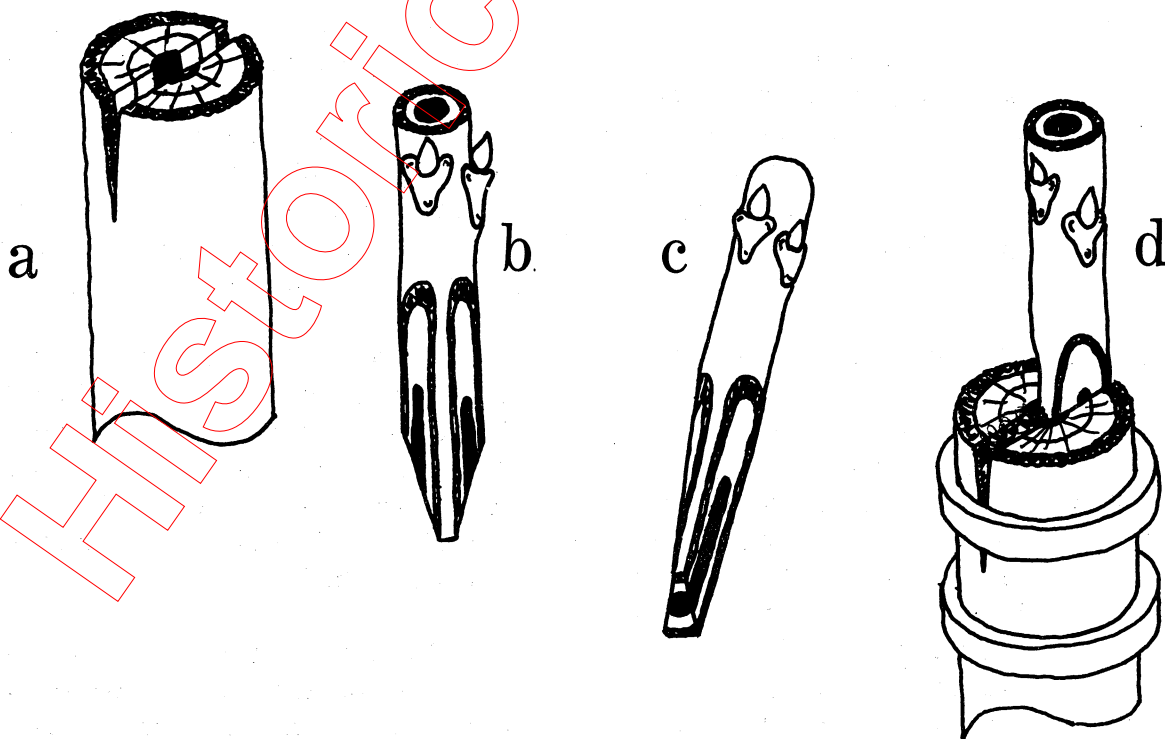


Figure 2. Cleft graft. A, stock; B, side view of scion; C, end view of scion; D, completed graft before waxing.

Table 1. Results of different propagation techniques -- 1968

Method	Number attempted	Number of successes	Percent success
Bark inlay	36	30	83.3
Cleft	25	12	48.0
Whip	37	0	0
T-bud	37	0	0
Patch bud	86	0	0

1. Preparation of the stock (Figure 2-A) --

- Sever the top of the rootstock just above the desired grafting point 10 to 14 days before grafting.
- Cut a disk from the top of the stock to expose live cambium at time of grafting.
- Split the stock lengthwise 2 to 3 inches deep.

e. Wax the grafted stock and scion.

f. Make occasional checks to replace the rubber strips as they deteriorate or aluminum foil may be wrapped securely around the stock to prevent deterioration.

g. Remove the adventitious shoots from the stock as they develop.

2. Preparation of the scion (Figures 2-B and C) --

- Make a sloping cut 2 inches long on one side.
- Make a second sloping cut the same length on the opposite side in the manner which will form a wedge, that is slightly thicker on the outer edge of the scion than it is on the inner edge.

Other Methods

Other methods studied were whip grafting, T-budding, and patch budding as described by Hartman and Kester (1961).

Because of the time involved in performing the whip graft, and the higher percentage of takes obtained with other techniques, this method appears unsatisfactory for field use with black walnut.

3. Completion of the graft (Figure 2-D) --

- The split in the stock should be held open with a wedge.
- Insert the scion in the stock with the thicker edge to the outside of the stock. The cambiums of the stock and scion should be aligned.
- Withdraw the wedge.
- Wrap the stock with a rubber strip and place tissue paper in the remaining portion of the cleft.

T-budding has been used to propagate a number of fruit trees and other thin-barked species with very good results. This method is fast and easy, but apparently the bark of even the small walnut trees is too thick to obtain a good fit around the margins of the bud.

Patch-budding has been used by many workers, but the results have been uncertain. Apparently, a patch is needed that is free of extra leaf scars. This requires rapid growth of the budwood, and budwood of this type is difficult to collect because of



Table 2. Results of 1969 clone bank establishment

Method	Number attempted	Number of successes*		Percent success	
		Initial	Final	Initial	Final
Bark inlay	98	75	53	76.5	54.1
Cleft	209	150	111	71.8	53.1
Patch bud	40	0	0	0	0

\* The reduction in number of successful grafts between the initial and final counts was due to cool weather just as many of the grafts started to grow, losses caused by insects and deer, and to wind damage.

its absence or its position in the crown of the tree. This method did not prove successful with black walnut.

Table 1 shows the experimental results obtained with the different grafting techniques in 1968.

### Discussion

The bark inlay technique is the fastest and easiest to perform in addition to having a good percentage of takes. This method has the disadvantage of requiring rootstocks that are at least an inch in diameter at the grafting point. If larger stocks are available, more than one scion can be grafted to each rootstock. Since the scion is on the side of the rootstock, it is especially important to maintain sufficient pressure on the graft to insure cambial contact until the graft union is callused.

Cleft grafting is relatively fast and easy, and it does not require 1-inch diameter rootstocks. After the scion is in place and wrapped, tissue paper can be used to absorb excess sap and to prevent the paraffin from filling the remaining portion of the cleft. The bark of the rootstock should be thicker than that of the scion. Thus, to maintain proper cambial contact the scion has to be set in from the outer edge of the rootstock (Figure 2-D). It is important to make the cuts on the scion long enough to

obtain good cambial contact between the stock and scion. If the cuts are too short, the scion will taper too abruptly to have proper cambial contact. However, it is just as important not to make the cuts too long so that the scion is tapered to a long slender tip which causes bark slippage on the scion, low carbohydrate reserves in the tip of the scion and promotes rapid drying of the scion.

Success in grafting depends to a great extent upon weather conditions during grafting and immediately after. Cloudy, windless, relatively cool (50 to 70 degree F) weather provides ideal conditions for grafting. A few days after grafting, fair skies and warmer temperatures (80 degree F. days, 50 degree F nights) are desirable. This promotes rapid callusing and bud break. If a cool, moist period follows bud break, growth ceases and insect problems will develop. However, if good growing conditions prevail, the rapid growth of shoots usually stays well-ahead of insect damage. Grafting should not be undertaken when temperatures exceed 85 degrees F.

Depending upon weather conditions, April 20 to May 10 is probably the optimum grafting time in central Indiana. Bud break should begin within 5 to 7 days after grafting. However, some grafts may not show signs of life for up to 30 days and still become successful grafts. Often, the first buds to open are male flower buds. These should be

pinched back so that leaf buds will be forced into growth. If flower buds are allowed to fully develop, the graft often fails. The male flower in walnut is a catkin, and when it breaks dormancy it resembles a cluster of grapes.

### Conclusions

When performed as previously described, either the cleft graft or the bark inlay technique is satisfactory for establishing black walnut seed orchards (Table 2). If large rootstocks (greater than 1 inch at the grafting point) are available, bark inlay is the most appropriate method. However, when small rootstocks (less than 1 inch at the grafting point) are used the cleft graft is suitable.

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